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THE GLAZED FROST OF JANUARY 1940

The glazed frost which began on January 27th and which was briefly noticed in the *Meteorological Magazine* for February, p. 12, presented a number of points of interest. Numerous reports now available show that it occurred over the greater part of southern and western England and in Wales, from Berkshire and Hampshire in the east to Merioneth and Devon in the west and Cheshire in the north.

The following notes arranged more or less geographically have been summarised from the reports sent in mainly by observers.

In eastern England the glazed frost did not occur, but there was heavy snow on the 27th and again on the night of the 28th to 29th, which according to Mr. D. L. Champion, lay 15 inches deep on level ground in Herts. The snow was " adhesive " and formed cornices on the eastern side of railway cuttings, in some places overhanging by as much as a yard.

The most easterly counties from which occurrences have been reported are Berkshire (by Mr. J. S. Dines in the *Meteorological Magazine* for February), and Hampshire, in both of which the phenomenon was highly developed. In Berkshire the thickness of the ice coating on twigs was about one inch, but long icicles hung from the foliage, showing that the freezing of the falling raindrops was not instantaneous as it appears to have been further west, probably because the drops themselves were larger.

In Hampshire conditions were described by Mr. C. J. P. Cave in a letter to *The Times*. A very fine rain began

to fall on the evening of the 27th with an air temperature just above 31° F., but Mr. Cave points out that since temperature had been above freezing point all day, exposed objects cannot have been below freezing point when ice began to form on them, so that the drops of rain and mist must themselves have been super-cooled. Precipitation continued all through the 28th, sometimes fairly heavy, and telephone wires were encased in cylinders of ice more than an inch in diameter, with the greatest thickness on the east. The wind rose on the night of the 28th and branches of trees and telephone posts were brought down by the weight (Mr. Cave calculated that on a single telephone wire between adjacent posts there was 85 to 90 lb of ice). He does not mention icicles and the freezing appears to have been instantaneous. Mr. J. F. Nixon of Micheldever, Hants, gives a similar account, and adds, " I think the most amazing sight of all was to see some pheasants which were unable to fly because their wings had become glued! "

In Gloucestershire reports were received from the neighbourhood of Stroud (see p. 12) and Bristol. On high ground near Stroud the ice formation began about 5 p.m. on the 27th, but at Bristol, further to the south-west, it was not noticed until 4.30 a.m. on the 28th. The diameter of the ice cylinders on telephone wires was again about one inch.

For Herefordshire reports are available from Malvern and Ross-on-Wye. At Malvern the formation began on the night of the 27th to 28th. The coating of clear ice on telephone wires was measured and found to be $1\frac{1}{2}$ inches in diameter. Many branches and some whole trees were brought down; but for the absence of wind the damage would have been much greater. Further to the south-west at Ross-on-Wye, the glazed frost began early on the morning of the 28th. Mr. F. J. Parsons describes it as " rain falling on and off most of the day interspersed with drizzle which froze as it fell. Footpaths and roads were alternately like sheets of glass or covered with a disintegrated mass of small pieces of

R.A.F. Photograph

FIG. 1.—NEAR HULLAVINGTON, JANUARY 30TH, 1940

R.A.F. Photograph

FIG. 2.—CLOSE-UP OF GRASS, JANUARY 30TH, 1940

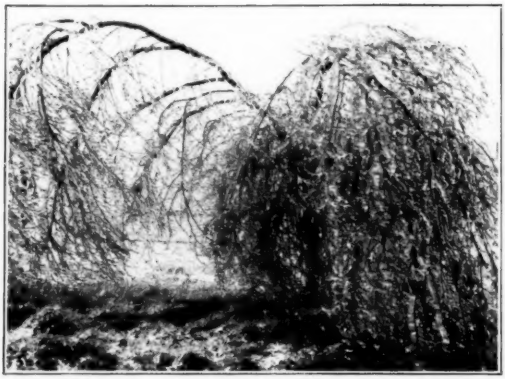

FIG. 3.—TREE BROKEN BY WEIGHT OF GLAZED FROST. PORTON, JANUARY 29TH, 1940

Photographer, O. G. Sutton

FIG. 4.—ICE FORMATION ON TWIGS, JANUARY 29TH, 1940

Photographer, O. G. Sutton

FIG. 5.—CLOSE-UP OF WIRE-NETTING, JANUARY 30TH, 1940

R.A.F. Photograph

ice." He also refers to icicles hanging from the grass-minimum thermometer, so that apparently the freezing was not so complete as in Gloucester.

At Rhayader, Radnorshire, according to Mr. E. Vaughan, rain began to fall with a south-east wind about 15h. on the 27th and from about 17h. it was super-cooled, freezing as it fell. The ice was from three-quarters to one and a half inches thick on the upper side of twigs and rarely more than one quarter inch on the lower side, showing that the freezing was instantaneous. Similar conditions were general in Montgomery, Radnor, Brecon and the high ground of Cardigan but near the sea. The ice was much thicker on the high ground than in the valleys. According to R. G. Sandeman, at Crickhowell in Breconshire, south-east of Rhayader, the glazed frost occurred on the 28th. At Bala, Merioneth, the rain began to freeze as it fell after 18h. on the 27th giving a coating of ice from half to an inch thick. Between Bala and Trawsfynydd for about $2\frac{1}{2}$ miles every telegraph post was either broken or bent. About 11 miles east of Bala the precipitation was in the form of snow and there were deep drifts on the lower ground in Denbigh and Cheshire. Mr. S. E. Ashmore writes that in the Bwlchgwyn district, near Wrexham the precipitation was in the form of dry snow on January 27th; this was followed by a period of sleet, rain and soft hail, and then during nearly the whole of the 28th by small drops of super-cooled water, which froze on everything it touched. The air temperature was about 25° F. Afterwards the air became still colder and snow fell again until the morning of the 29th. On posts, walls, windows, etc. there was a coating of clear ice often several inches thick. The snow had a similar coating, thick enough to support pedestrians and in many places even motor cars. On twigs the ice was often well over two inches thick, adhering to the south-east side. The ice was only disposed symmetrically on objects which had previously been horizontal, such as telephone wires which in some cases seem to have carried cylinders of ice four inches in diameter. There was

further glazed frost on the 31st followed by the formation of rime.

At West Kirby, Cheshire, the Rev. E. F. Robson reported a prolonged fall of " frozen rain " which began at 15h. 30m. on January 27th and continued almost without interruption for over 30 hours. Here, however, it seems that the rain froze before reaching the ground.

Returning to south-west England, Lord St. Audries reported that at Bridgwater, in Somerset, rain continued almost without ceasing from midday on the 26th until about 10h. on the 29th. The rain began to freeze as it fell about 21h. on the 28th (at higher levels about midday on the 28th). This is 12 hours later than at Bristol and 24 hours later than Stroud. At Exeter, Devon, Mr. W. N. Lavis reported that a drizzle which froze on contact with the ground began about 20h. on the 30th, two days after Bridgwater. The thickness of the ice was from one eighth to one quarter of an inch. At Princetown, Dartmoor, there was no true glazed frost but rime formed on the 29th. Finally Mr. J. Porter mentioned glazed frost at Garvagh, Co. Londonderry, on the morning of January 31st.

From these summaries some interesting points emerge:

1. The area covered by glazed frost lay to the south-west of a sharp line from Hampshire to North Wales.
2. The time of commencement became progressively later in the direction north-east to south-west. This is shown in the isochrones represented by the full lines of fig. 6. The broken lines in that figure show the position of a " front " with which the glazed frost was associated.

The distribution of winds and temperatures on January 27th to 30th showed a cold front running east or south-east across the English Channel. To the south-west of this front the wind was south-westerly and the temperature about 50° F., while to the north-east the

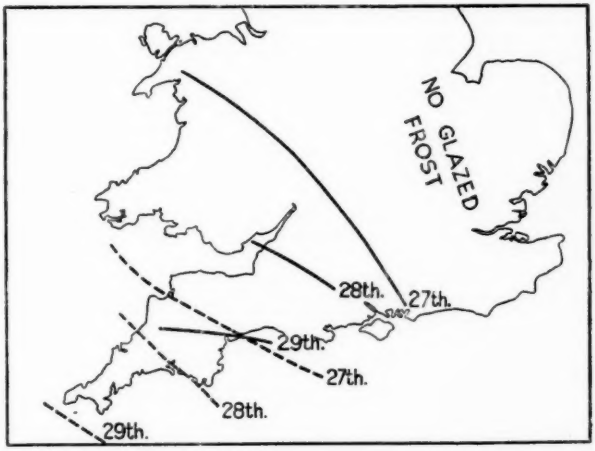

FIG. 6.—ISOCHRONES AT BEGINNING OF GLAZED FROST AND POSITION OF FRONT AT 18H. ON SUCCESSIVE DAYS

[Reports received after this article was in the press show that the formation of glazed frost began in the Midlands on the 25th and 26th, and extended on the 26th and 27th eastwards as far as Cambridge, Hampstead and Bexhill.]

wind was easterly and the temperature below freezing point over the greater part of southern England. On the north-eastern side of the front there must have been a marked inversion at a height of a few thousand feet. Fine rain falling from this warm upper layer was cooled below 32° F. in the underlying cold layer, but the droplets were able to survive without freezing until they struck some solid object, such as a tree, telephone wire or road, when they froze instantly.

The front moved very slowly south-westwards from the Severn Estuary to the Scilly Isles, and the beginning of the glazed frost followed in its wake. The duration and thickness of ice were greatest in the east and north, where the damage was enormous. Several observers stated that the woods looked as if they had been stripped by shell-fire. The ice was slow to melt and there was even a second occurrence of glazed frost on February 3rd.

Mr. R. Alan S. Thwaites of the North Wales Power Co. Ltd., contributes some interesting notes* on the interruption in the electricity supply of North Wales, due to ice accretion on power transmission lines. He attributes the trouble to fine particles of ice and rain freezing round the overhead conductors. In isolated positions on high ground the normal three-eights inch diameter was sometimes increased to more than four inches. The extra weight together with a wind of high velocity was in some instances enough to break the conductor, bend the iron work, smash the insulator pin and even to drag the poles to within six feet of the ground. The ice was so hard that it could only be removed with a hammer, all attempts to remove it by ropes or long rods being quite ineffective.

The ice accretion in the Wrexham area was opaque and irregular while in the Dolgarrog area it was clear.

LETTERS TO THE EDITOR

The Severn Bore

On Sunday February 25th, 1940, the highest predicted tide of the year occurred in the Bristol Channel, a height of 45·9 feet above datum being attained at King Road at Avonmouth. Range of tide on that day was as great as 47·3 feet, low water being 1·4 feet below datum.

Having frequently heard of the Severn Bore I journeyed to Stone Bench, about 2 miles below Gloucester, to see this phenomenon. It was high water at King Road at 9h. 36m. G.M.T. I got to Stone Bench where the river runs alongside the road, at about

* A similar note appeared in the *Electrical Review* Feb. 9th, 1940.

9h. 15m. The current was flowing strongly down river at about 5 knots I reckoned when we arrived, and continued to do so without any apparent abatement until the moment of arrival of the Bore, which occurred at 9h. 30m. and which forcibly and suddenly reversed this current.

Just before 9h. 30m. a solid wall of water was observed sweeping round a curve of the river below which we stood. It advanced upstream at an estimated speed of about 12 knots, the height of its crest, as far as I could judge, being about 6 feet. The wave had no tendency whatever to break except on the sides where it washed up against the bank.

I was impressed by the relentless forward march of this wave and the orderly way in which it wheeled round bends of the river, like troops wheeling in line with the inside man marking time. The only sound was the swishing noise of the water against the banks.

There was very little wind at the time, with a high barometer. Bearing in mind the effect of barometric pressure and wind upon tides one presumes that had there been a fresh south-westerly wind and low pressure, the Bore would have been much higher and more impressive and it would perhaps have caused flooding in places.

Immediately the Bore had passed up river the water level was, of course, raised about 5 to 6 feet and the tide began to run strongly upstream. The tide continued to flood strongly at Stone Bench for about one hour after the Bore had passed, slack water occurring at 10h. 30m. I should say the actual rise of the tide was about 10 feet. Flood tide is experienced at Gloucester for about four days only, near the time of full and change of the moon, and lasts about one hour. The Bore itself starts 2 miles above Sharpness at a rate increasing from $3\frac{3}{4}$ knots at first to $13\frac{3}{4}$ knots at Rosemary, after which it gradually decreases.

C. E. N. FRANKCOM.

Meteorological Office, Stonehouse, Glos.
March 1st, 1940.

The Study of Air Mass Analysis—A correction

In the September–October, 1939, issue of *The Meteorological Magazine* there appeared a review by Mr. C. J. Boyden of my series of articles "An Introduction to the Study of Air Mass Analysis."

Mr. Boyden commented on the point that the American practice, according to one of my articles, is to indicate the occluded front on the surface weather map directly below the upper trough of warm air. Unfortunately, this statement of mine was an error which appeared in the early editions of the articles and was undiscovered until quite recently (after the printing of the 4th edition). The common practice in America, which I believe is generally accepted throughout the meteorological services of the world, is to draw the occluded front on the surface weather map along a line separating polar air originally occupying the region ahead of the warm front from polar air which has come from the region behind the cold front. In cases of warm-front type occlusions the position of the upper air trough (sometimes called the upper cold front) is also indicated if it is well defined by observations, particularly by a discontinuity of pressure tendency.

JEROME NAMIAS.

Massachusetts Institute of Technology,
Cambridge, Mass., U.S.A.
November 16th, 1939.

Snow Shower with Cloudless Sky

Although falls of snow or ice crystals with clear sky are reported to occur fairly frequently in more northerly latitudes, they are of sufficient rarity in England to warrant placing them on permanent record. Such a fall was observed at Wyton at about 12h. 30m. G.M.T. on January 17th, 1940, its duration being some fifteen minutes.

At 12h. the sky was 2/10 to 3/10 covered with stratus cloud at about 2,000 feet, moving from NNW. By 12h. 30m. the sky was clear and a steady fall of

snow crystals began which attracted considerable attention. Towards 13h., after the snow had ceased, patches of stratus cloud again crossed the station. At Upwood, some seven or eight miles to NNW, 8/10 of cloud at 1,000 to 2,000 feet was reported at 12h.; this slowly decreased to 1/10 by 13h. Winds at 1,500 feet were also available for that station which showed the direction to be 340 degrees from north and the speed 25 m.p.h.

As there was considerably more cloud at Upwood than at Wyton during the period 12h.–13h. it seems probable that the snow had formed somewhere to NNW and drifted down with the wind (temperature was below freezing point at all heights), rather than produced by the small amount of cloud which had crossed Wyton earlier.

This phenomenon was also observed at Huntingdon, some three miles to SW of Wyton.

Meteorological Office, Wyton. WM. JAMES.
January 20th, 1940.

Auroral Glow and Sunspots

During the foggy high-pressure weather of the first week of January, the fog which had on the morning of the 3rd been of the type E (Observers' Handbook, 1934, page 59) cleared as the pressure steadied after a 36 hours fall of 7·0mb. At about 22h. 15m. G.M.T., a fairly bright but rather ill-defined auroral glow was visible, though none of the characteristic colours were observed.

On the following day, and on the 5th and 6th, about 10h. 15m. G.M.T. a peculiarly large sunspot, visible to the naked eye, was seen to the right-hand corner of the sun, which shone red through the film of fog. Actually the sunspot was double, consisting of a large and a smaller spot connected by a thin line.

I wonder if any other readers have observed similar auroral light, coinciding with this large spot.

FERGUS MACPHERSON.

7, Wardie Crescent, Edinburgh 5.
January 7th, 1940.

NOTES AND NEWS

Early Weather in China.

An interesting article on "Meteorological Records from the Divination Inscriptions of Shang," by K. A. Wittfogel, in the *Geographical Review* for January, 1940, throws some light on the climate of Northern China between about 1600 and 1100 B.C. On the site of a famous oracle, a large number of bones have been found, inscribed with questions and dated. Many of the questions refer to the occurrence of rain, others to agriculture, war, hunting, etc. The author reasonably assumes that, for example, the inquirer would not ask for rain unless experience had shown that there was a chance of rain at that season; in other words, the weather expectancy reflects the climate of the time. Sufficient dated questions have been found to give the relative frequency of rain throughout the year. The type of question shows that in spring rain is generally desired rather than expected, whereas in summer the opposite is the case. The author concludes that the annual distribution of rainfall resembled the present, but perhaps there was slightly more rain, especially in summer. There are few references to snow and this combined with the frequency of winter rain, points to a higher temperature than the present. The agricultural questions point to a longer growing year, and the probability of a warmer climate is further supported by the presence among the remains of bones of animals now only found in more southerly regions. The general conclusion is therefore that the climate of Northern China from 1600–1100 B.C. was warmer and perhaps rainier.

There is even some evidence of fluctuations within this period; one reign, which is alternatively dated as 1325 to 1267 or 1273 to 1214, is indicated as having slightly more summer rainfall than the average for the whole. It must be more than a coincidence that

C. E. P. Brooks (" Climate Through the Ages ") shows a rainfall maximum about 1275 B.C. in both Europe and Western Asia.

Deerness Climatological Station.

The old climatological station at Deerness in Orkney has ceased to function since September, 1939, when Mr. W. J. Moar, who was responsible for the observations, was transferred on appointment to the headship of Stenness School on the other side of the island.

The history of the station is of interest. The late Mr. Magnus Spence, who had made meteorological observations at Swanbister between 1885 and 1890, moved to Deerness Schoolhouse in March, 1891, and then set up the meteorological station which has continued there uninterruptedly for more than 48 years. Mr. Spence maintained the observations personally until his retirement early in 1919. His work was of the highest quality and during the strenuous war years, 1914–1918, he somehow found it possible, in addition to his work as a schoolmaster, to act as a telegraphic reporter for the Meteorological Office.

After Mr. Spence's retirement the observations were carried on for a time by Mr. William Delday, a local farmer, but Mr. Moar, who had succeeded Mr. Spence at the school, soon became interested in meteorology and began to undertake a large share of the observing duties. Since Mr. Delday's death in 1929 Mr. Moar has been solely responsible for the conduct of the station. The high standard of observation set by the late Mr. Spence was fully maintained by Mr. Moar.

Climatologically, Orkney will now be represented only by the station at Bignold Park, Kirkwall.

H. E. C.

Mr. W. G. Kendrew.

We have pleasure in announcing that Mr. W. G. Kendrew has been appointed University Reader in Climatology at Oxford.

General Rainfall, February, 1940.

	Per cent.
England and Wales	123
Scotland	87
Ireland	128
British Isles	106

Sunshine, February, 1940.

The distribution of bright sunshine for the month was as follows:—

	Total hrs.	Diff. from average hrs.		Total hrs.	Diff. from average hrs.
Stornoway	62	+ 7	Chester	36	−26
Aberdeen	45	−25	Ross-on-Wye	18	−51
Dublin	39	−36	Falmouth	49	−31
Birr Castle	49	−17	Gorleston	30	−45
Valentia	67	+ 1	Kew	23	−38

Kew temp., mean, 38.0° F. diff. from average—3.1° F.

REVIEWS

Vertical currents in the first few kilometres over Poona and their possible effect on the measures of upper winds made by pilot balloons assumed to rise at a known constant rate, by K. P. Ramakrishnan. Simla, Ind. Met. Dept. Sc., Notes VII 81, 1939.

It is to be expected that in a country like India where solar radiation is intense, strong vertical currents will occur and will affect the rate of ascent of balloons, particularly in the latter part of the day. For this reason the " tail method " has been used in following balloons in India for many years past so that the height at any instant can be computed. Recently a self-recording theodolite has been brought into use at a few stations for night ascents, working on the basis of a uniform rate of ascent and this has suggested the desirability of examining the errors which would result if a uniform rate were assumed for all ascents. The present paper is the result. Since April 1st, 1937, regular daily ascents have been made at Poona in the afternoon

as well as in the morning so that ample data are available for examination. Graphs showing the height of the balloon against time for a succession of days in May and November, 1937, are plotted and from these it is clear that while in the morning the rate of ascent agrees closely with that given by formula on most days, in the afternoon wide deviations frequently occur. In the region between 0 and 4 km. over a period of 12 months, in the mornings 93 per cent. of the balloons rose at a rate within 10 per cent. of that given by the formula and no deviation of as much as 30 per cent. occurred, whereas in the afternoons the percentage within 10 per cent. was only 51 and in 12 per cent. of the cases the deviation exceeded 30 per cent. If the balloon is assumed to rise at the "formula" rate the effect of an error in the assumed rate of ascent is twofold. In the first place the wind velocity deduced at any particular minute is in error and in the second place this velocity is ascribed to a height which is erroneous. The combined effect of these two errors may be considerable and a table is given showing the errors introduced by assuming a constant rate of ascent on six individual occasions. Errors of 90° in direction and 20 km/hr in velocity occur. Unfortunately it is not stated whether the six ascents chosen to illustrate this effect are random ones or extreme cases.

As regards the magnitude of the vertical currents the rate in the afternoon is generally of the order of 3-5 km/hr though on rare occasions it rises to 10 km/hr. If a balloon with a tail ascends through layers where the wind varies with height the tail will necessarily move out of the vertical. The error in the results deduced from the tail method of calculation can in this case be calculated. In an appendix to the paper the author examines this point and concludes that such errors are unimportant.

It may be mentioned that the tail method is widely used in the British Meteorological Office and it has been found that while it is superior in most cases to the simple method of assuming a uniform rate of ascent its accuracy

leaves a good deal to be desired compared with the two theodolite method. The present author appears to place considerable reliance on the results given by the tail method and the curves published in the paper certainly seem to suggest that good results are obtained from it. It would be of interest to know whether the readings are smoothed in any way before use or whether any special technique is employed in taking them. While an immense amount of information is now obtained every day regarding the horizontal currents in the atmosphere practically nothing is published about the vertical currents, and if for no other reason the present paper is to be welcomed in that it does direct attention to the importance of vertical currents and give some information regarding their magnitude.

J. S. DINES.

The cyclonic storms in Northern New Zealand on the 2nd February and the 26th March, 1936, by M. A. F. Barnett, Ph.D. Wellington Met. Office, Note No. 22, 1938.

In this paper Dr. Barnett has discussed two storms which travelled over North Island, New Zealand, during 1936. They are illustrated by synoptic charts drawn at 24-hour intervals. Observations are available at 12-hour intervals, but the stations at which they are made are scattered widely with the result that the frontal analysis appears of necessity to be rather speculative. This is mentioned in no way in disparagement of this most interesting paper but because it is felt that the really important part of the contribution is the reaction of the storms and the fronts.

To take the second of Dr. Barnett's cases first, in the first chart of this storm the low pressure area is drawn as associated with a front in low latitudes and as having reached an advanced stage of occlusion. Without more detailed information it is not possible to dogmatize but the evidence of the charts is not inconsistent with it being a true circular storm in its early stages without any very definite frontal structure. By the time, how-

ever, when it was crossing New Zealand there was a warm front occlusion formed in front of the storm. Whether this occlusion was formed by the circulation of the storm or the storm was due to the presence of the occlusion, there are not sufficient data to say, but to the present reviewer the former is a possibility by no means to be neglected.

The other case which Dr. Barnett discusses is an abnormality in that the example chosen was the worst storm for 38 years and did very extensive damage.

In its early stages the maps show the storm associated with a decidedly speculative frontal structure, moving south-south-east towards New Caledonia. At the same time there was cold air moving north eastwards over South East Australia with a decided cold front preceding it. The movement of this cold front cannot (at any rate on the charts presented) be traced with any precision, but by some means between the chart for January 31st and that for February 2nd there was a linking up between the rotating storm and the front. At the same time there was a great intensification of the depth of the storm. A similar type of linking up of a revolving storm with a pre-existent front has been known to occur off the Eastern Coasts of the United States, but the process of the linking has not been traced. The present reviewer cannot but contemplate the possibility that the immediate effect of the proximity of the rotating storm to the front was a new development of low pressure on the front and that this new development rapidly masked the old storm centre, as was the case illustrated in the Quarterly Journal of the Royal Meteorological Society, Volume 63, page 355. A process such as that would account for the sudden leap forward of the centre between January 31st and February 2nd. But, however the linking occurred, there is no question but that the marriage of the revolving storm and the front produced a cyclone with a very marked warm sector, which tore its way across North Island spreading flood and ruin in its train.

C. S. DURST.

Birmingham and Midland Institute. Records of Meteorological Observations taken at the Observatory, Edgbaston, 1939, Price 2s. Falmouth Observatory. Report of the Observatory Committee with Meteorological Notes and Tables for the year 1939.

We are pleased to note that these two valuable meteorological reports are published as usual. The daily Edgbaston records are edited by the observer, Mr. A. L. Kelley, and the monthly means and extremes are compared with those of the past 40 or 50 years. The Falmouth report is presented by the Hon. Secretary to the Observatory Committee, Mr. H. Dent Gardner, and includes full notes, monthly summaries with monthly normals and annual extremes for 1871 to 1935, compiled by Mr. W. Tregoning Hooper, Superintendent of the Observatory.

OBITUARY

A. E. Pycock. The death of Mr. A. E. Pycock severs another of the links with the early history of the Meteorological Office. He was active and apparently in good health up to the end and passed away peacefully in his sleep in the early morning of February 9th in his 75th year.

Mr. Pycock was appointed to the staff of the office in September, 1887 when it was in Victoria Street, Westminster, for duty in the Telegraph Branch, the forerunner of the Forecast Division. At that time there was no information available to the forecaster westward of Valencia and we are told in the Annual Reports that the morning observations at British and Irish stations were taken at 8 a.m. and " the majority of the telegrams usually arrive between 9 a.m. and 10 a.m."

The greater part of his service was spent, however, in the Statistical Branch (now the Climatology Division) where he was identified particularly with the production of the Weekly and Monthly Weather Reports, until he retired on pension in 1931.

This note would not be complete without reference to the fact that he was, for many years, a well-known humorous entertainer and, under the name of Fred Edwards, appeared frequently at evening concerts in various parts of London and in the Provinces.

He will always be remembered for his remarkably happy and cheerful disposition and as a very steady and conscientious man in his official work.

DR. C. C. VIGURS. It is with much regret that we announce the death on January 24th, 1940 of Dr. C. C. Vigurs, for many years Medical Officer of Health at Newquay.

Dr. Vigurs was responsible for the meteorological station at Newquay from 1903 and although in 1936 he had given up most of the actual observational work he continued the supervision of the station.

He took a keen and lively interest in meteorology and did much work in local climatology. He often contributed to this Magazine and his annual reports on the weather of Newquay were widely circulated and did much to increase the popularity of the town. In addition he was well known for his botanical work and for his interest in local legends and folk-lore.

Dr. Vigurs will long be remembered in the Meteorological Office not only for his valuable meteorological work but also for his characteristic letters and comments; his racy and unconventional style were often a relief to more sober official correspondence.

ERRATUM

Climatological Table for the British Empire, July 1939. Page 20.

Sydney, N.S.W. Absolute Min. *For* 49 *read* 39.

Rainfall: February, 1940: England and Wales

Co.	Station.	In.	Per cent of Av.	Co.	Station.	In.	Per cent of Av.
Lond'n	Camden Square.....	1·41	84	*Warw*	Alcester, Ragley Hall.	2·45	148
Surrey	Reigate, Wray Pk. Rd.	2·59	118	,,	Birminghm, Edgbaston	2·38	141
Kent	Tenterden, Ashenden.	1·72	87	*Leics*	Thornton Reservoir...	3·00	180
,,	Folkestone, I. Hospital	2·11	..	,,	Belvoir Castle.....	2·53	151
,,	Margate, Cliftonville..	1·52	110	*Rutl'd*	Ridlington	..	..
,,	Edenb'dg..Falconhurst	2 50	113	*Lincs*	Boston, Skirbeck.....	..	..
Sussex	Compton, Compton Ho	4·91	186	,,	Cranwell Aerodrome..	2·16	144
,,	Patching Farm.....	2·96	134	,,	Skegness, Marine Gdns	2·69	176
,,	Eastbourne, Wil. Sq..	2·54	114	,,	Louth, Westgate.....	2·01	105
Hants	Ventnor, Roy.Nat.Hos.	3·94	188	,,	Brigg, Wrawby St....	1·74	..
,,	Southampton, East Pk	2·95	128	*Notts*	Mansfield, Carr Bank..	2·56	133
,,	Ovington Rectory....	3·82	147	*Derby*	Derby, The Arboretum	..	..
,,	Sherborne St. John...	2·90	132	,,	Buxton, Terrace Slopes	2·56	68
Herts	Royston, Therfield Rec	1·59	103	*Ches*	Bidston Obsy.....	2·16	128
Bucks	Slough, Upton.....	1·92	113	*Lancs*	Manchester, Whit. Pk.	1·88	98
Oxford	Oxford, Radcliffe.....	2·19	134	,,	Stonyhurst College...	2·14	64
N'hant	Wellingboro,Swanspool	2·26	140	,,	Southport, Bedford Pk	2·24	107
,,	Oundle	2·50	..	,,	Ulverston, Poaka Beck	..	..
Beds	Woburn, Exptl. Farm.	1·83	124	,,	Morecambe.....	1·72	68
Cambs	Cambridge, Bot. Gdns.	2·00	156	,,	Blackpool.....	1·86	83
,,	March	2·02	157	*Yorks*	Wath-upon-Dearne...	4·49	280
Essex	Shoeburyness.....	1·10	89	,,	Wakefield,Clarence Pk.	2·77	162
,,	Lexden Hill House....	2·26	..	,,	Oughtershaw Hall....	2·81	..
Suff	Haughley House.....	·99	..	,,	Harrog'te, HarlowMoor	1·90	87
,,	Campsea Ashe, High Ho	1·36	99	,,	Hull, Pearson Park...	1·66	100
,,	Lowestoft Sec. School.	1·29	92	,,	Holme-on-Spalding...	2·17	129
,,	Bury St. Ed.,WestleyH	1·58	105	,,	Felixkirk, Mt. St. John	1·56	92
Norf.	Wells, Holkham Hall.	..	..	,,	York, Museum.....	1·37	91
,,	Thetford W. W.....	1·52	..	,,	Scarborough.....	1·42	85
Wilts	Porton, W.D. Exp'lStn	2·96	149	,,	Middlesbrough.....	1·80	138
,,	Bishops Cannings	3·11	147	,,	Baldersdale, Hury Res.	..	..
Dorset	Weymouth, Westham.	..	..	*Durhm*	Ushaw College.....	2·01	126
,,	Beaminster, East St ..	4·68	155	*Norl'd*	Newcastle, Leazes Pk.	2·19	143
,,	Shaftesbury	3·49	..	,,	Bellingham, Highgreen	1·15	45
Devon	Plymouth, The Hoe...	5·39	181	,,	Lilburn Tower Gdns..	1·80	90
,,	Holne, Church Pk.Cott	9·87	179	*Cumb*	Carlisle, Scaleby Hall.	2·12	95
,,	Teignmouth, Den Gdns	4·22	159	,,	Borrowdale,Seathwaite	6·50	58
,,	Cullompton	3·76	135	,,	Thirlmere,DaleHeadH.	..	..
,,	Sidmouth, U.D.C.....	3·77	..	,,	Keswick, High Hill...	1·76	30
,,	Barnstaple,N. Dev.Ath	3·59	132	,,	Ravenglass, The Grove	1·60	52
,,	Dartm'r,Cranmere P'l	8·50	..	*West*	Appleby, Castle Bank.	1·18	40
,,	Okehampton, Uplands.	5·43	124	*Mon*	Abergavenny, Larchf'd	3·78	118
Cornw	Bude, School House ..	..	..	*Glam*	Ystalyfera, Wern Ho..	6·25	122
,,	Penzance,Morrab Gdns	5·04	151	,,	Treherbert, Tynywaun	9·81	..
,,	St. Austell, Trevarna..	6·72	175	,,	Cardiff, Penylan.....	3·47	119
Soms	Chewton Mendip.....	3·36	100	*Carm*	St. Ann's Head.....	5·27	189
,,	Long Ashton	2·29	97	*Card*	Aberystwyth	4·71	..
,,	Street, Millfield	2·10	107	*Radn'r*	Bir. W. W. Tyrmynydd	4·75	..
Glostr	Blockley	2·98	..	*Mont*	Lake Vyrnwy.....	4·25	..
,,	Cirencester, Gwynfa ..	3·06	135	*Flint*	Sealand Aerodrome...	2·45	166
Here	Ross-on-Wye	2·20	109	*Mer*	Blaenau Festiniog....	6·95	90
,,	Kington, Lynhales....	3·26	131	,,	Dolgelley, Bontddu...	5·68	120
Salop	Church Stretton.....	..	..	*Carn*	Llandudno	2·81	144
,,	Shifnal, Hatton Grange	2·24	138	,,	Snowdon, L. Llydaw 9	13·20	..
,,	Cheswardine Hall	2·91	163	*Angl*	Holyhead, Salt Island.	4·07	167
Worc	Malvern, Free Library.	2·91	162	,,	Lligwy.....	3·89	..
,,	Ombersley, Holt Lock.	2·51	153	*I.Man*	Douglas, Boro' Cem...	4·18	137

Rainfall: February, 1940: Scotland and Ireland

Co.	Station.	In.	Per cent of Av.	Co.	Station.	In.	Per cent of Av.
Guern.	St. Peter P't. Grange Rd.	3·64	84	*R&C.*	Stornoway, C.G.Stn...	1·91	45
Wig.	Pt. William, Monreith.	2·44	79	*Suth.*	Lairg	1·14	37
,, .	New Luce School.....	2·73	71	,, .	Skerray Borgie.....	1·31	..
Kirk.	Dalry, Glendarroch...	2·09	41	,, .	Melvich.....	1·05	35
Dumf.	Eskdalemuir Obs.....	2·83	57	,, .	Loch More, Achfary..	2·97	45
Roxb.	Hawick, Wolfelee	1·25	38	*Caith.*	Wick	·71	31
,, .	Kelso, Broomlands....	1·11	65	*Orkney*	Kirkwall, Bignold Park	1·18	37
Peebs.	Stobo Castle.....	1·37	50	*Shet.*	Lerwick Observatory.	2·21	70
Berw.	Marchmont House....	1·55	75	*Cork.*	Cork, University Coll.	7·93	213
E.Lot.	North Berwick Res...	·81	52	,, .	Roches Point, C.G.Stn.	5·41	146
Midl.	Edinburgh, Blackfd. H	·87	53	,, .	Mallow, Hazlewood ..	5·67	..
Lanark	Auchtyfardle	1·20	..	*Kerry.*	Valentia Observatory.	7·07	136
Ayr.	Kilmarnock, Kay Park	1·44	..	,, .	Gearhameen	10·09	113
,, .	Girvan, Pinmore	1·92	45	,, .	Bally McElligott Rec.	5·24	..
,, .	Glen Afton, Ayr San..	2·00	45	,, .	Darrynane Abbey....	5·36	116
Renf.	Glasgow, Queen's Park	1·57	53	*Wat.*	Waterford, Gortmore.	5·56	173
,, .	Greenock, Prospect H.	2·50	47	*Tip.*	Nenagh, Castle Lough.	3·17	102
Bute.	Rothesay, Ardencraig.	1·84	46	,, .	Cashel, Ballinamona..	4·19	133
,, .	Dougarie Lodge.....	1·90	50	*Lim.*	Foynes, Coolnanes....	3·99	125
Argyll	Loch Sunart, G'dale..	..	..	,, .	Limerick, Mulgrave St.	4·28	137
,,	Ardgour House	4·38	..	*Clare.*	Inagh, Mount Callan..	7·07	..
,,	Glen Etive	4·87	57	*Wexf.*	Gorey, Courtown Ho..	4·53	161
,,	Oban	2·68	..	*Wick.*	Rathnew, Clonmannon	4·40	..
,,	Poltalloch	2·98	69	,, .	Newcastle.....	..	..
,,	Inveraray Castle	4·18	62	*Carlow*	Bagnalstown FenaghH	5·38	212
,,	Islay, Eallabus	3·19	76	,, .	Hacketstown Rectory.	5·63	188
,,	Mull, Benmore.....	7·00	63	*Leix.*	Blandsfort House	4·80	179
,,	Tiree	2·98	87	*Offaly.*	Birr Castle	3·86	..
Kinr.	Loch Leven Sluice....	1·65	58	*Dublin*	Dublin, Phoenix Park.	3·33	186
Fife.	Leuchars Aerodrome..	1·02	58	*Meath.*	Kells, Headfort.....	2·99	111
Perth.	Loch Dhu	4·05	54	*W.M.*	Moate, Coolatore.....	3·38	..
,, .	Crieff, Strathearn Hyd.	2·40	68	,, .	Mullingar, Belvedere..	3·43	123
,, .	Blair Castle Gardens..	1·58	57	*Long.*	Castle Forbes Gdns ..	4·62	163
Angus.	Kettins School.....	2·30	98	*Galway*	Galway, Grammar Sch.	4·02	132
,, .	Pearsie House	2·88	..	,, .	Ballynahinch Castle ..	4·42	86
,, .	Montrose, Sunnyside..	1·49	81	,, .	Ahascragh, Clonbrock.	2·52	82
Aberd.	Balmoral Castle Gdns.	1·20	46	*Rosc.*	Strokestown, C'node..	4·48	169
,, .	Logie Coldstone Sch ..	..	..	*Mayo.*	Blacksod Point	2·84	70
,, .	Aberdeen Observatory.	1·70	83	,, .	Mallaranny	4·13	..
,, .	New Deer SchoolHouse	1·89	89	,, .	Westport House.....	4·23	107
Moray	Gordon Castle	·90	47	,, .	Delphi Lodge.....	10·56	125
,, .	Grantown-on-Spey ...	·85	40	*Sligo.*	Markree Castle.....	3·67	105
Nairn.	Nairn.....	·63	35	*Cavan.*	Crossdoney, Kevit Cas.	3·78	..
Inv's.	Ben Alder Lodge.....	..	..	*Ferm.*	Crom Castle	3·69	126
,, .	Kingussie, The Birches	1·04	..	*Arm'h*	Armagh Obsy.....	2·78	125
,, .	Loch Ness, Foyers....	..	..	*Down.*	Fofanny Reservoir ...	8·60	..
,, .	Inverness, Culduthel R	1·48	66	,, .	Seaforde	3·49	114
,, .	Loch Quoich, Loan....	..	..	,, .	Donaghadee, C. G. Stn.	2·09	90
,, .	Glenquoich	3·90	38	*Antrim*	Belfast, Queen's Univ .	3·05	123
,, .	Arisaig House	3·01	61	,, .	Aldergrove Aerodrome	2·17	90
,, .	Glenleven, Corrour ...	2·89	44	,, .	Ballymena, Harryville.	2·51	77
,, .	Ft. William, Glasdrum	3·42	..	*Lon.*	Garvagh, Moneydig...	2·46	..
,, .	Skye, Dunvegan	4·71	..	,, .	Londonderry, Creggan.	3·15	99
,, .	Barra, Skallary	2·27	..	*Tyrone*	Omagh, Edenfel.....	3·21	108
R&C.	Tain, Ardlarach.....	1·20	48	*Don.*	Malin Head.....	2·91	98
,, .	Ullapool	1·20	28	,, .	Dunfanaghy	..	..
,, .	Achnashellach	4·17	57	,, .	Dunkineely.....	3·27	..

Climatological Table for the British Empire, August, 1939

STATIONS.	PRESSURE. Mean of Day M.S.L.	PRESSURE. Diff. from Normal.	TEMPERATURE. Absolute. Max.	TEMPERATURE. Absolute. Min.	TEMPERATURE. Mean Values. Max.	TEMPERATURE. Mean Values. Min.	TEMPERATURE. Mean Values. ½ Max. and Min.	TEMPERATURE. Mean Values. Diff. from Normal.	TEMPERATURE. Mean. Wet Bulb.	Relative Humidity.	Mean Cloud Am'nt	PRECIPITATION. Am'nt.	PRECIPITATION. Diff. from Normal.	PRECIPITATION. Days.	BRIGHT SUNSHINE. Hours per day.	BRIGHT SUNSHINE. Percentage of possible.
	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	%	0–10	in.	in.			
London, Kew Obsy	1016·6	+ 1·3	80	50	70·7	56·1	63·4	+ 1·7	57·3	90	7·8	3·43	+ 1·19	12	5·6	39
Gibraltar	1015·4	− 1·1	81	63	77·3	66·0	71·7	− 4·3	64·6	82	3·3	0·00	—	0	10·7	79
Malta	1016·8	+ 2·0	95	69	86·1	73·9	80·0	+ 0·9	71·9	71	2·7	0·04	− 0·10	1	10·8	80
St. Helena	1020·5	− 0·6	65	52	61·5	54·5	58·0	+ 1·0	55·4	88	8·7	2·77	+ 0·28	23	—	—
Freetown, Sierra Leone	1013·5	+ 2·4	87	68	82·9	73·8	78·3	—	72·5	87	9·2	25·70	−10·87	25	—	—
Lagos, Nigeria	1013·9	+ 0·9	83	68	80·6	72·0	76·3	− 1·6	72·6	92	9·0	5·56	+ 2·92	15	2·5	20
Kaduna, Nigeria	1012·5	—	87	63	80·6	66·6	73·6	− 0·7	69·1	95	9·0	11·51	− 0·81	27	4·0	32
Zomba, Nyasaland	1016·8	− 0·1	82	51	74·6	56·6	65·6	+ 0·7	60·2	74	4·7	1·53	+ 1·16	4	—	—
Salisbury, Rhodesia	1020·6	+ 0·7	79	38	73·1	47·3	60·2	0·0	51·5	58	2·3	0·18	—	1	9·4	82
Cape Town	1020·6	+ 0·3	80	37	64·8	48·4	56·6	+ 1·0	50·1	85	6·1	2·69	− 0·68	15	—	—
Johannesburg	1022·4	− 0·5	72	29	62·7	42·2	52·5	− 1·9	43·3	64	4·6	1·19	+ 0·68	4	8·5	76
Mauritius	1021·1	+ 0·5	78	53	74·7	61·2	67·9	− 0·6	64·2	69	4·9	1·13	− 1·12	20	7·9	70
Calcutta, Alipore Obsy.	999·3	− 1·7	95	75	87·8	78·5	83·1	− 0·1	79·4	90	9·2	21·66	+ 8·28	20*	—	—
Bombay	1005·0	− 0·9	89	72	84·9	76·5	80·7	− 0·1	76·6	84	8·6	10·87	− 3·58	19*	—	—
Madras	1004·3	− 1·2	101	75	96·2	80·1	88·1	+ 2·1	74·4	61	7·3	0·86	− 3·68	3*	—	—
Colombo, Ceylon	1009·8	+ 0·5	86	73	84·0	77·3	80·7	+ 0·5	76·6	80	7·3	6·76	+ 3·52	7	7·3	59
Singapore	1008·7	− 0·8	90	72	85·9	75·9	80·9	− 0·2	77·3	81	8·4	7·76	− 0·19	17	5·5	45
Hongkong	1002·4	− 2·4	93	72	87·2	77·4	82·3	+ 0·2	77·8	80	5·8	12·82	− 1·58	20	6·7	52
Sandakan	1006·8	—	92	73	89·7	76·6	83·1	+ 1·3	76·6	77	8·0	1·51	− 6·38	5	—	—
Sydney, N.S.W.	1007·0	−11·2	81	58	66·0	48·1	57·1	+ 2·1	48·6	56	3·3	2·94	− 0·03	7	7·6	70
Melbourne	1005·4	−12·6	67	33	57·1	44·9	51·0	0·0	46·7	75	7·8	4·35	+ 2·48	27	2·2	20
Adelaide	1010·1	− 9·1	69	35	60·4	44·7	52·5	− 1·5	48·8	78	6·2	3·13	+ 0·59	20	4·9	45
Perth, W. Australia	1020·6	+ 1·7	69	39	63·1	48·8	55·9	− 0·1	48·4	53	5·6	8·69	+ 3·04	23	6·4	59
Coolgardie	1015·4	− 3·9	74	33	62·1	41·9	52·0	− 3·6	47·1	72	3·6	0·84	− 0·15	9	—	—
Brisbane	1010·7	− 8·5	88	41	70·8	50·4	60·6	+ 0·2	52·1	58	1·7	2·29	+ 0·28	4	9·3	83
Hobart, Tasmania	999·6	−13·8	60	35	53·0	42·6	47·8	− 0·2	43·8	76	8·4	4·20	+ 2·37	30	3·4	33
Wellington, N.Z.	1002·4	−12·7	60	34	53·3	42·6	47·9	− 0·7	45·6	79	6·6	5·91	+ 1·42	18	4·5	43
Suva, Fiji	1011·8	− 2·4	89	62	80·0	69·0	74·5	+ 0·9	69·8	85	6·6	6·55	− 1·74	18	5·6	49
Apia, Samoa	1010·1	− 2·2	86	67	84·5	74·3	79·4	+ 1·6	74·9	74	3·7	2·13	− 1·50	9	9·4	80
Kingston, Jamaica	1012·8	− 0·7	94	70	90·3	74·0	82·1	+ 0·6	71·9	78	2·2	1·33	− 2·22	4	8·3	65
Grenada, W.I.	1007·1	− 5·5	92	72	90·0	75·0	82·5	+ 2·8	76·6	76	3·5	3·53	− 5·80	14	—	—
Toronto	1014·2	− 1·2	87	57	81·3	63·2	72·3	+ 5·1	62·7	80	2·8	4·17	+ 1·38	7	10·2	73
Winnipeg	**1012·7**	**− 0·5**	**94**	**46**	**79·8**	**55·8**	**67·8**	**+ 4·0**	**55·5**	**83**	**4·5**	**5·51**	**+ 3·35**	**14**	**8·6**	**59**
St. John, N.B.	**1016·3**	**+ 1·0**	**84**	**51**	**74·1**	**57·4**	**65·7**	**+ 5·1**	**60·4**	**86**	**6·2**	**1·64**	**− 2·22**	**11**	**8·0**	**57**
Victoria, B.C.	**1017·2**	**+ 0·3**	**87**	**50**	**71·3**	[illegible]	[illegible]	**+ 2·4**	**57·2**	**75**	**3·4**	**0·31**	[illegible]	**4**	**10·2**	[illegible]

* For Indian stations [illegible]